

tubelet. The protective screen surrounds the probe and has itself the shape of a small tubelet being adjusted to the probe and slideable over the probe with a tight fitting. The small tubelet of steel, i.e. the protective screen, in contrast to a foil, has an inherent stability. This tight fitting is hard to achieve as the small tubelets of the solid electrolyte are producable only 5 with some tolerances at the outer periphery. A close contact of the inner periphery of the small tubelet of steel to the outer periphery cannot be obtained. Air and oxygen will always remain in the interstice between the solid electrolyte and the protective screen and affect the measurement at low oxygen levels in the melt. The arrangement given in US patent 4 342 633 has the purpose of thermal protection and cannot fulfill the purpose of the invention.

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Japanese publications JP 56100353 A2, JP 56100354 A2 and JP 56092450 A2 disclose coatings of the solid electrolyte probe improving the measurement behavior of the probe in molten steel. In JP 56100353 A2 a coating is presented with a metal like Fe, Cu, Ni, Mg, Al or a metal oxide like MgO, Al<sub>2</sub>O<sub>3</sub> or similar made by vaporizing, sputtering, ion 15 plating or another method. From JP 56100354 A2 the covering of the solid electrolyte with a metal oxide powder like MgO, Al<sub>2</sub>O<sub>3</sub> or similar in an organic binder is known that results into an accelerated heat transfer and an improved process reaction rate. JP 56092450 A2 teaches an oxygen activity of about 35ppm, thus a low level range, is mentioned. In JP 56092450 A2 a coating of a mixture of a metal powder and an organic binder to improve the 20 wettability of the solid electrolyte probe through the molten steel is described. Between the probe and the steel no thermal isolating layer is to be established. This will reduce the reaction time of the device.

The coverings in the form of coatings need an additional costly apparatus and bear the 25 risk of exfoliating off from the surface of the solid electrolyte upon its immersion into the melt.

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On the other hand, the covering of the entry surface with a foil arrangement according to the invention has the advantage of greater simplicity, and exfoliating like in a coating will not take place.

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The foil arrangement can have at least one foil oxidizable by oxygen in the metal melt and can for example consist of an aluminum material. Other materials which may be used as the oxidizable foil are amongst others titanium, tin, magnesium for example, because they are easily oxidizable.

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Such a foil melts instantly upon contact with the hot melt and reacts with the oxygen that may have been drawn in at the surface of the probe during immersion into the melt. This oxygen therefore cannot falsify the measurement any longer.

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The foil arrangement can have at least one second functional foil at least partly covering or overlapping the first foil on its outer or inner side.

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It may be advantageous that the material of the second foil when melting enhances the wettability of the entry surface of the solid electrolyte in contact with the melt so that the solid electrolyte will have uniform contact with the melt.

A foil with such a function can be made of a copper material. Further examples for the material of the second foil are Pb, Ag, Zn, Sn, Au, Pt, Bi, Mg.

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In case the solid electrolyte is provided in the form of a plug-like piece of material tightly fixed in the open end of a refractory small tubelet and having a substantially flat front

What is claimed:

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1. A probe (100, 200, .300, 400, 500, 600) for the measurement of the oxygen activity of metal melts, in particular steel melts,  
5 comprising a reference substance (2) of known oxygen activity in electrically conducting contact (3) with a measuring device; and comprising a solid electrolyte predominantly oxygen ion conducting and negligibly electron conducting at high temperatures and separating the reference substance (2) from the metal melt and having an entry surface (4) for oxygen ions which is in contact  
10 with the metal melt,  
wherein the entry surface (4) of the probe ready for operation is covered by a functional foil arrangement (10,20) in close contact to the entry surface(4).
2. A probe according to claim 1, wherein the foil arrangement (10,20) comprises at least  
15 one foil (6) oxidizable by the oxygen drawn into the melt during immersion.
3. A probe according to claim 2, wherein the foil (6) is made from at least one of the groups of aluminium, titanium, tin or magnesium material
- 20 4. A probe according to any of the claims 1 to 3, wherein the foil arrangement (20) comprises at least a second foil (9) at least partly covering the first foil on ist inner or outer side.
5. A probe according to claim 4, wherein the material of the second foil when melting  
25 due to the contact with the metal melt enhances the wettability of the entry surface (4) of the solid electrolyte (11).

6. A probe according to claim 5, wherein the second foil (9) consists of a copper material.

5 7. A probe according to any of the claims 1 to 6, wherein the solid electrolyte is provided in the form of a material having an essentially plane formed front wall at the end of a refractory small tubelet (1) and the foil arrangement (10, 20) extends in front of said end wall.

10 8. A probe according to any of the claims 1 to 6, wherein the solid electrolyte is provided in the form of a coating on a carrier pin or a small carrier tubelet and wherein the foil arrangement (10,20) totally and tightly surrounds the outer periphery of the solid electrolyte.

15 9. A probe according to any of the claims 1 to 7, wherein the solid electrolyte is provided in the form of a small tubelet (1) that is immersed into the metal melt and is closed at the end to be immersed and the reference substance (2) is located in the interior of the small tubelet and the foil arrangement (10,20) totally and tightly surrounds the outer periphery of the small tubelet (1).

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10. A probe according to any of the claims 1 to 9, further comprising means to keep the foil arrangement (10,20) in close contact to the entry surface (4).

25 11. A probe according to claim 10, wherein said means comprise a binder located between the entry surface (4) and the foil arrangement (10,20) and disintegrating when in contact with the metal melt .

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12. A probe according to claim 11, wherein said means are mechanical means, which press the foil arrangement (10,20) from outside into close contact with the entry surface (4).

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13. A probe according to claim 12, wherein said means press the foil arrangement (10,20) against the entry surface (4) over its extension.

14. A probe according to claim 13, wherein said means press the foil arrangement (10,20)

10 against the entry surface (4) elastically.

15. A probe according to claim 14, wherein said means comprise an elastomeric hose (8,18) tightly surrounding the foil arrangement (10,20) on the outer periphery of the small tubelet (1) constituting the solid electrolyte.

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16. A probe according to claim 15, characterized in that the hose (8, 18) first has a greater diameter than the foil arrangement (10,20) surrounding the small tubelet (1) and that the hose is shrinkable in its radial diameter after being positioned longitudinally over the foil arrangement (10,20).

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17. Probe according to claim 16, wherein the hose (8,18) is made of a material with a thermoactive shape memory.

- 25 18. A method of producing a probe (100, 200, 300, 400, 500) for the measurement of oxygen activity of metal melts, in particular steel melts, wherein the probe comprises a reference substance (2) of known oxygen activity in electrically conducting contact (3)

with a measuring device and comprising a solid electrolyte that is predominantly oxygen conducting at high temperatures and negligibly electron conducting and intended to be immersed into the metal melt and having a entry surface for oxygen ions, wherein the entry surface (4) is tightly covered by a functional foil arrangement (10,20); wherein over the foil arrangement (10,20) on the entry surface (4) an elastomeric hose (8,18) is positioned longitudinally and wherein then a hose (8,18) is shrunk onto the foil arrangement (10,20) causing a radial tension leading to a close contact between the foil arrangement (10,20) and the entry surface (4).

10 19. A method according to claim 18, wherein the hose (8,18) is made out of a thermoactive shape memory material and the hose (8,18) is heated when in position.